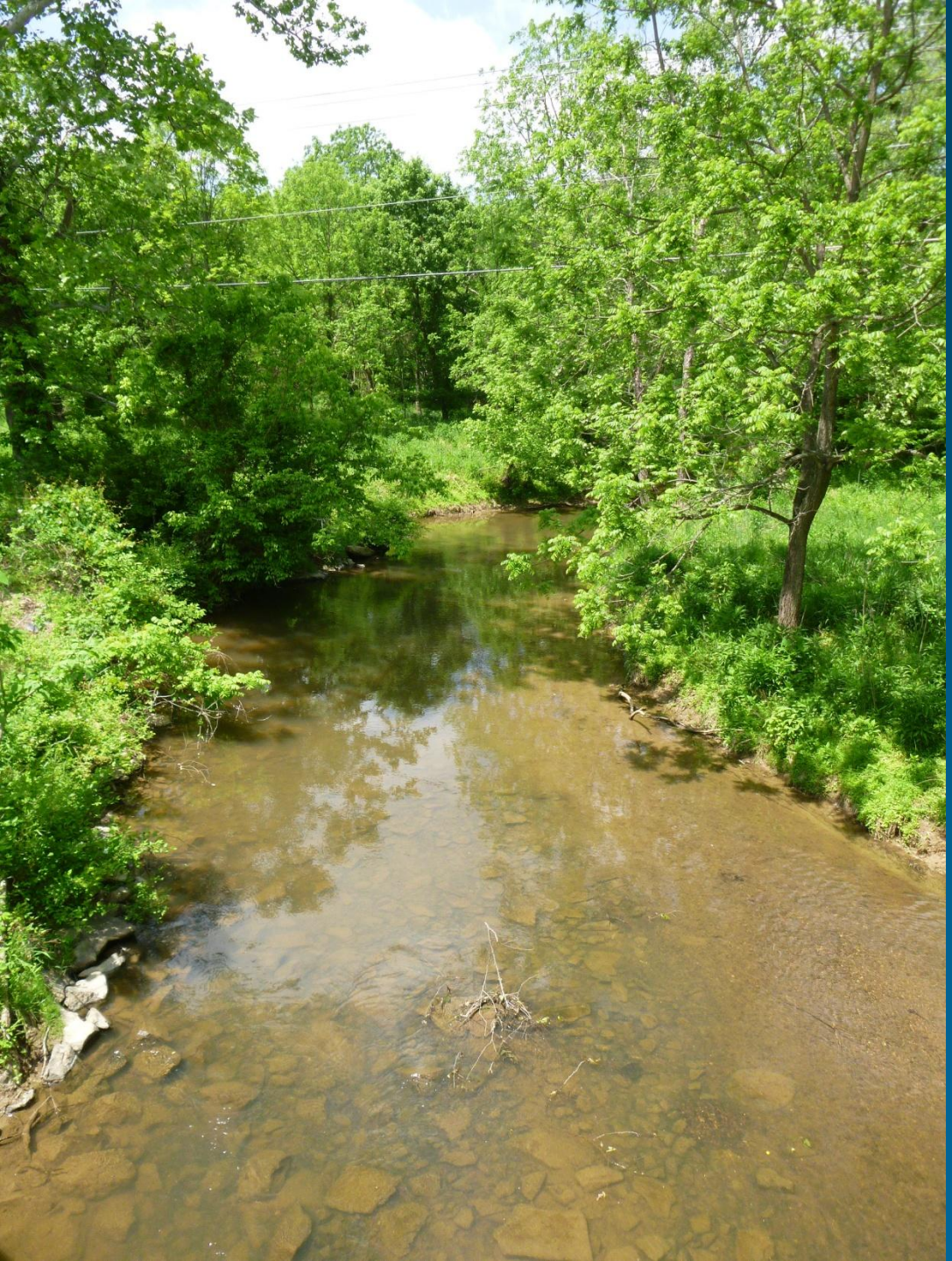


Benthic Total Maximum Daily Load Study for North Fork Catoctin Creek

Public Meeting #1
August 3, 2015

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Meeting Agenda

1. Introductions

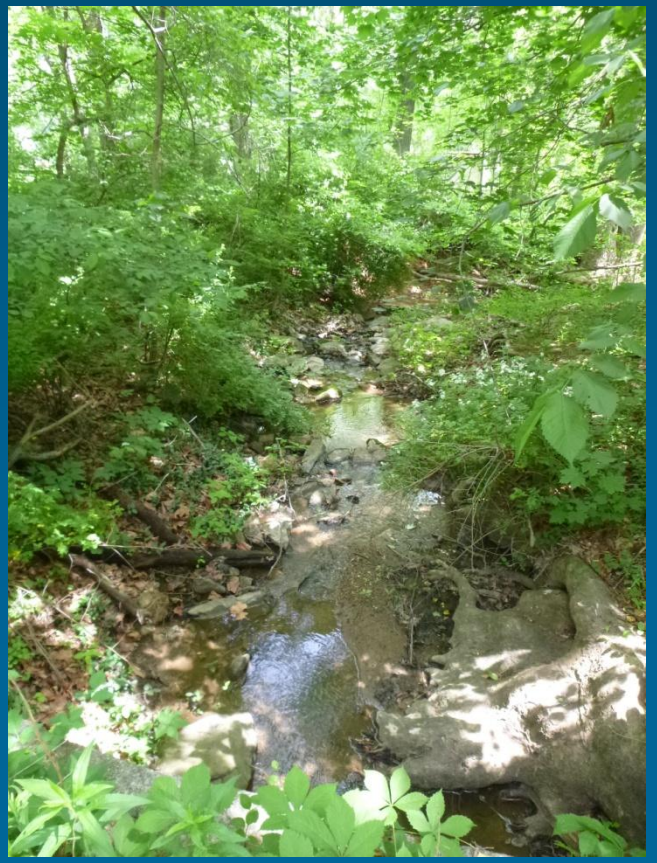
2. Overview of North Fork Catoctin Creek Impairments

3. Water Quality Information Process
    a. Monitoring
    b. Assessment
    c. TMDLs & Stressor Analysis

4. Stressor Analysis Results
    a. Data Sources
    b. Eliminated Stressors
    c. Possible Stressors
    d. Most Probable Stressors

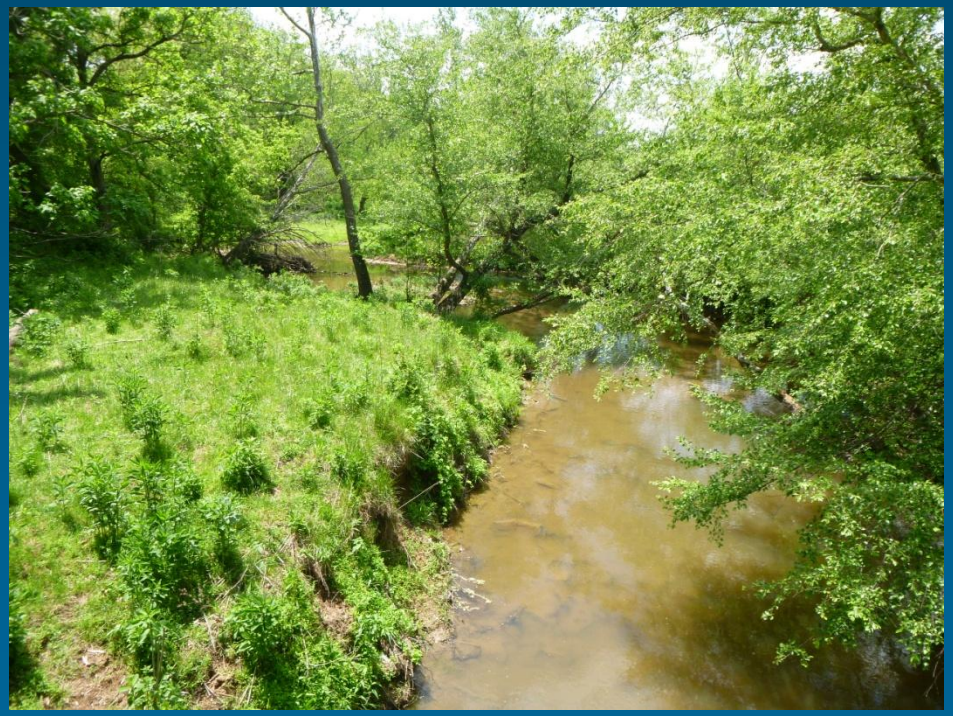
5. Summary & Next Steps

6. Questions & Discussion

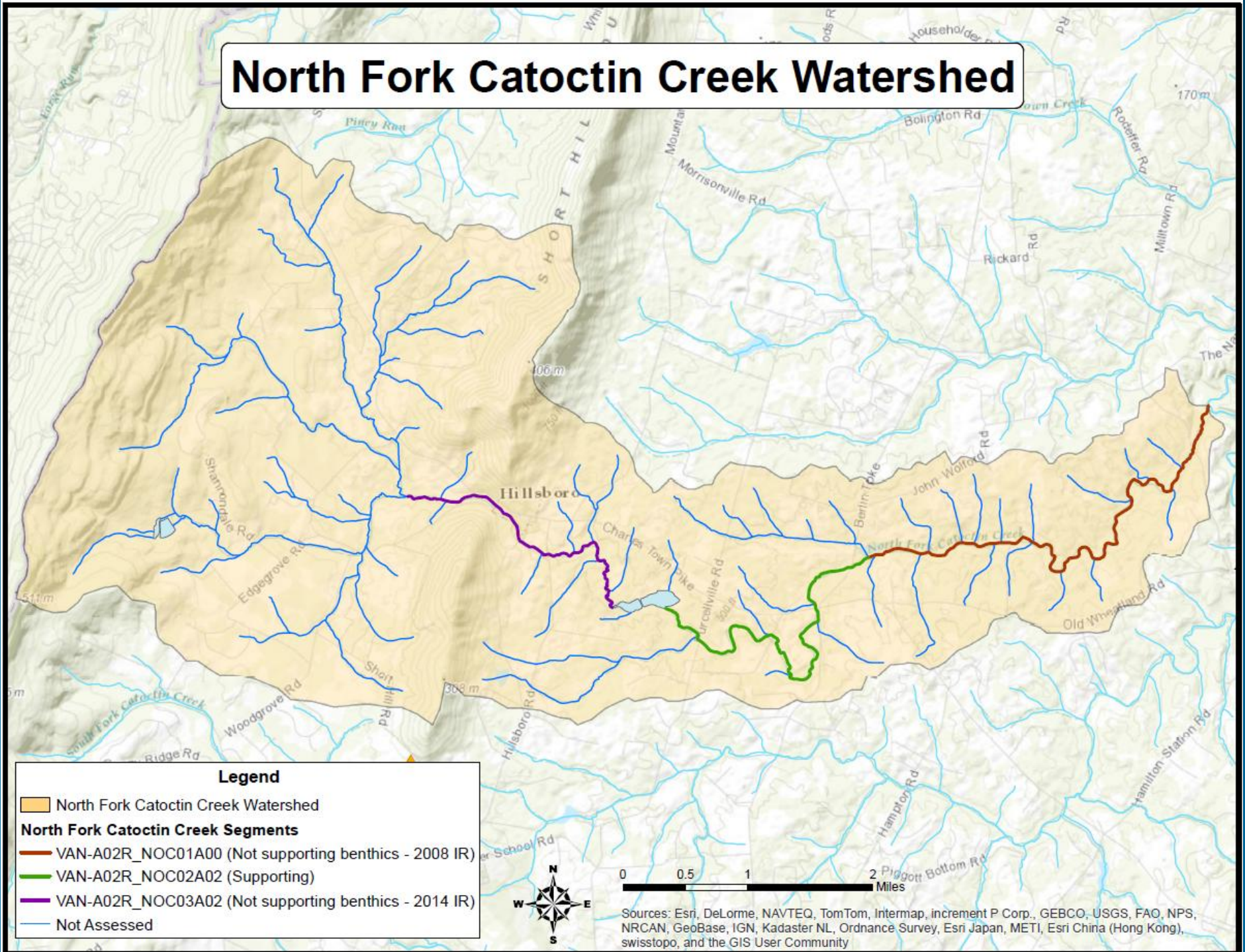


Why are we here?

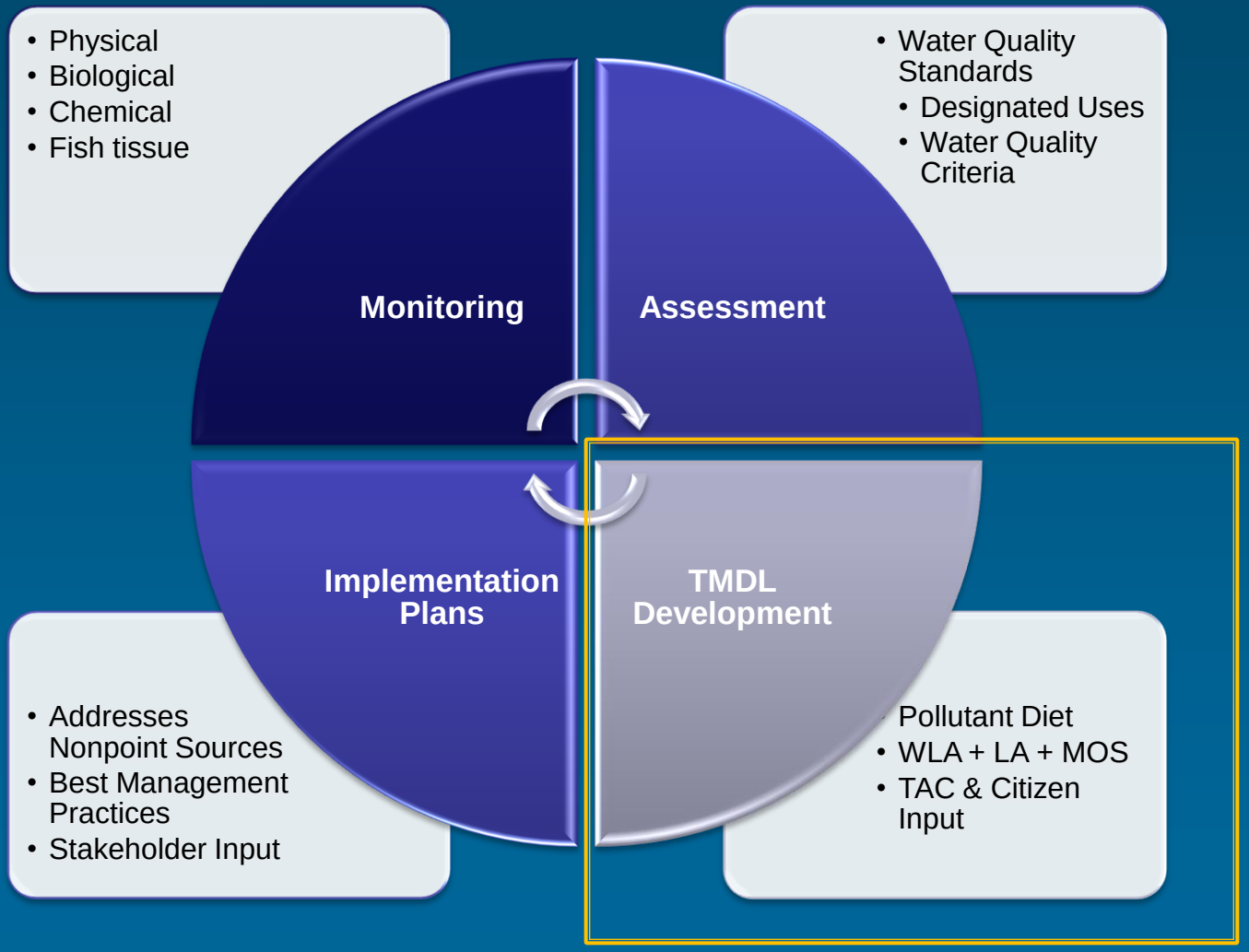
- To share details of the water quality in portions of North Fork Catoctin Creek
- To explain efforts that Virginia is undertaking to improve and protect water quality



North Fork Catoctin Creek Watershed



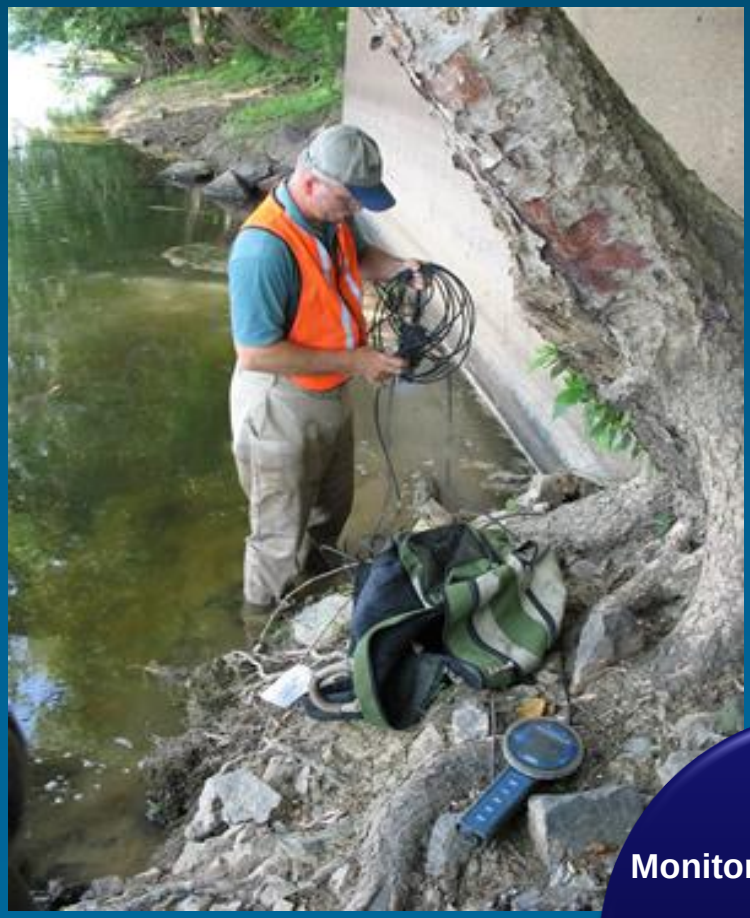
Water Quality Information Process



How do we know if water bodies in Virginia are healthy?

- Perform physical and chemical monitoring on water bodies throughout the state

- Monitor parameters such as:
  - pH
  - Temperature
  - Dissolved Oxygen
  - Biological Community
  - Bacteria
  - Nutrients
  - Fish Tissues
  - Metals/Toxic Pollutants



Monitoring

Designated Uses

- Shellfish
- Public Water Supply
- Recreation
- Wildlife
- Fish Consumption
- Aquatic Life

The attainment of the aquatic life use is evaluated by testing for the health of the benthic macroinvertebrate community, as well as for parameters such as dissolved oxygen and pH.

Aquatic Life Use: What are benthic macroinvertebrates?

Aquatic invertebrates that live on the bottom of streams, rivers, and other bodies of water.

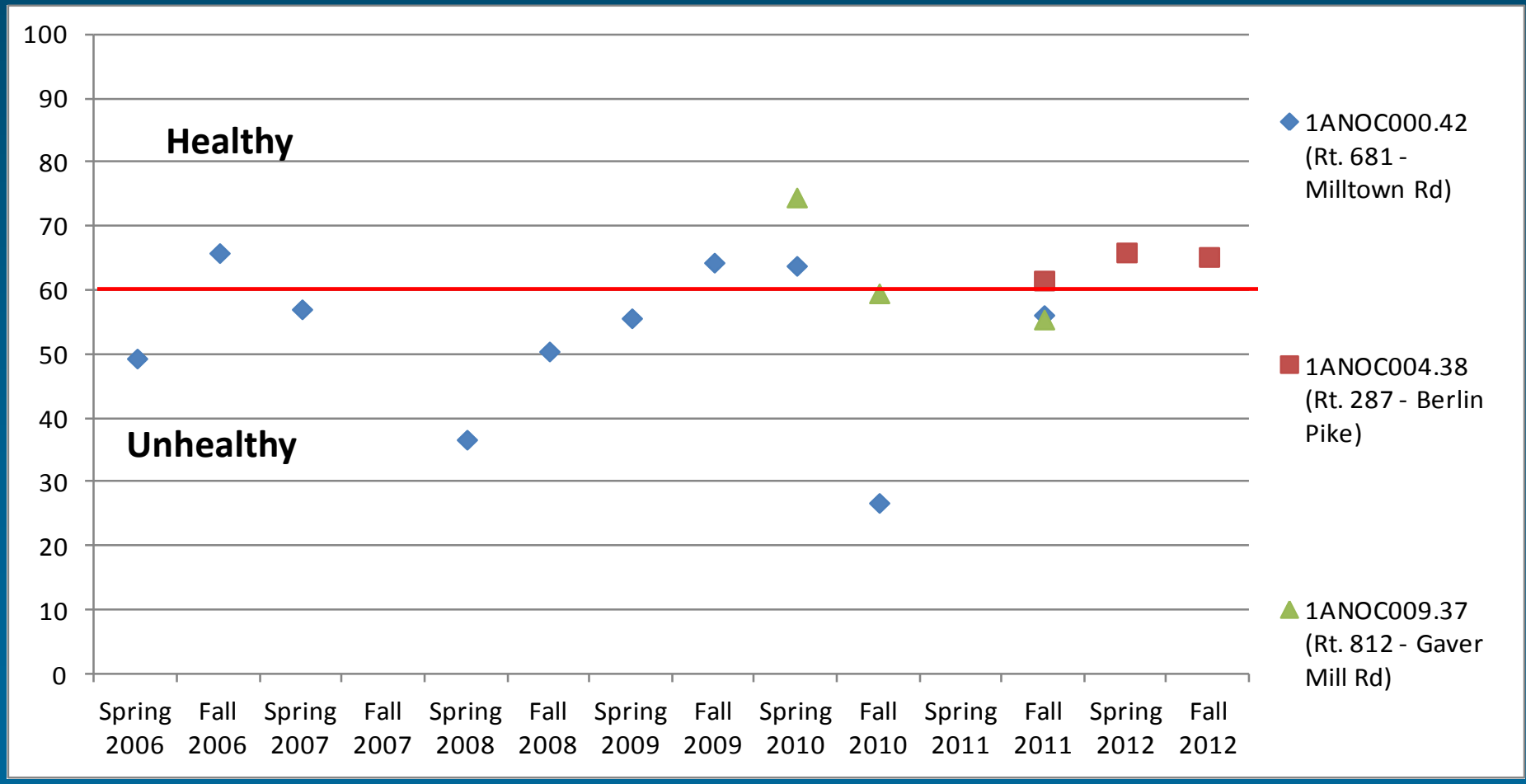
Pollution Intolerant Invertebrates

Moderately Pollution Tolerant Invertebrates

Highly Pollution Tolerant Invertebrates

What are the bugs like in North Fork Catoctin Creek?

Bugs are collected and identified, and the stream is given a score based off the number and type of bugs present in the stream. If the stream gets a score of 60 or above, it is considered healthy.



What happens when a water body doesn't meet water quality standards?

- Waterbody is listed as "impaired" and placed on the 303(d) list
- Once a water body is listed as impaired, a Total Maximum Daily Load value must be developed for that impaired stream segment to address the designated use impairment.
- TMDL Studies are required by law:
  - 1972 Clean Water Act (CWA)
  - 1997 Water Quality Monitoring Information and Restoration Act (WQMIRA)

Assessment

TMDL Development

What is a TMDL ?

Total Maximum Daily Load

TMDL = Sum of WLA + Sum of LA + MOS

Where:

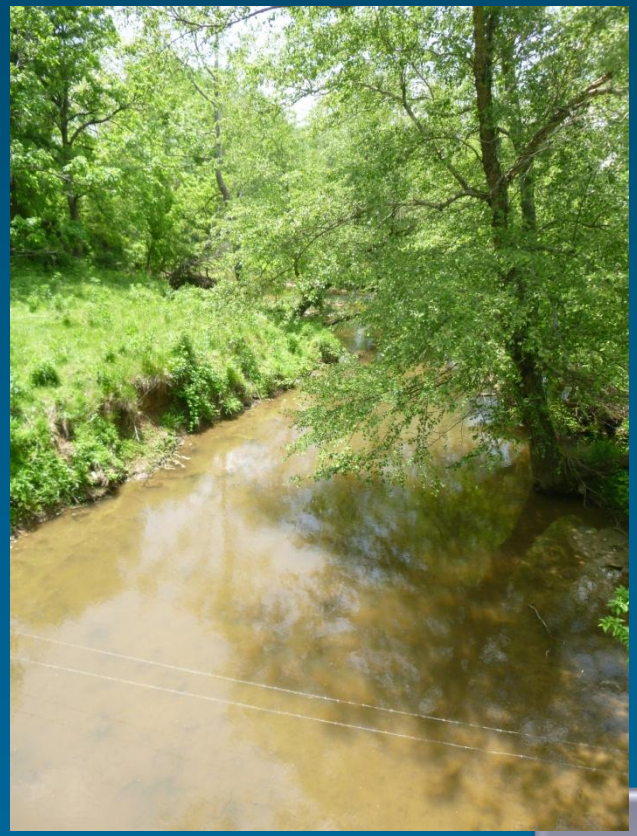
TMDL	**=**	**Total Maximum Daily Load**
WLA	**=**	**Waste Load Allocation (Point Sources)**
LA	**=**	**Load Allocation (Non-point Sources)**
MOS	**=**	**Margin of Safety (Implicit or Explicit)**

A TMDL is the total amount of a certain pollutant that a water body can receive and still not exceed water quality standards.

How are TMDLs developed for benthic impairments?

- The cause of poor biological health is not known

- Two general phases:
  1. Stressor analysis
  2. TMDL development



What is a Stressor Analysis?

Answers the question: ***What is causing the aquatic life impairment?***

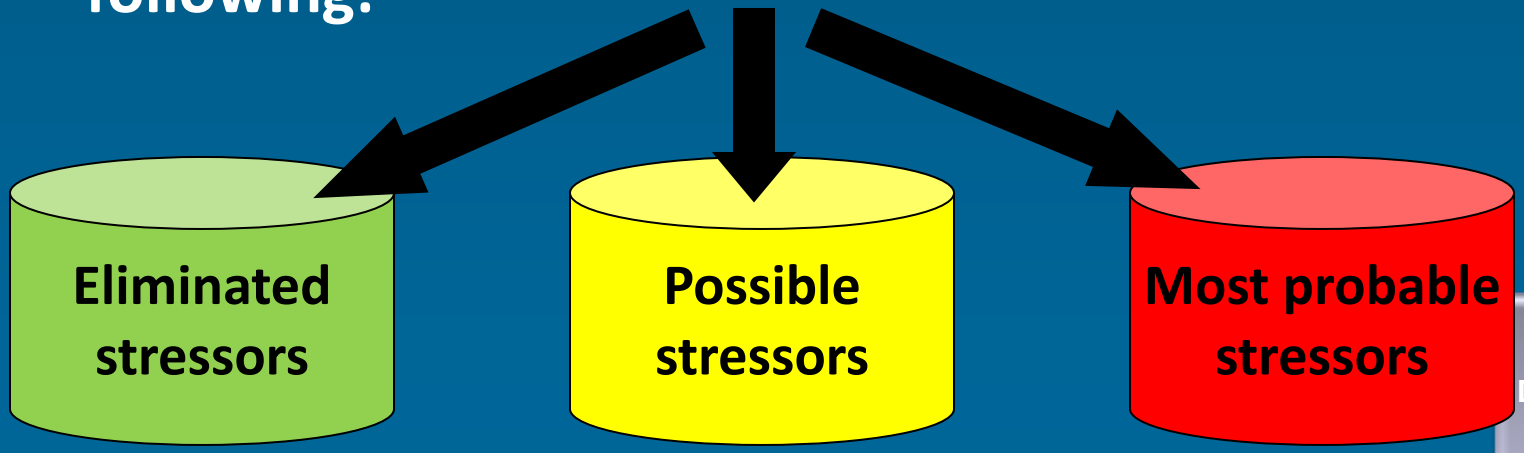
1. List all potential causes, for example:

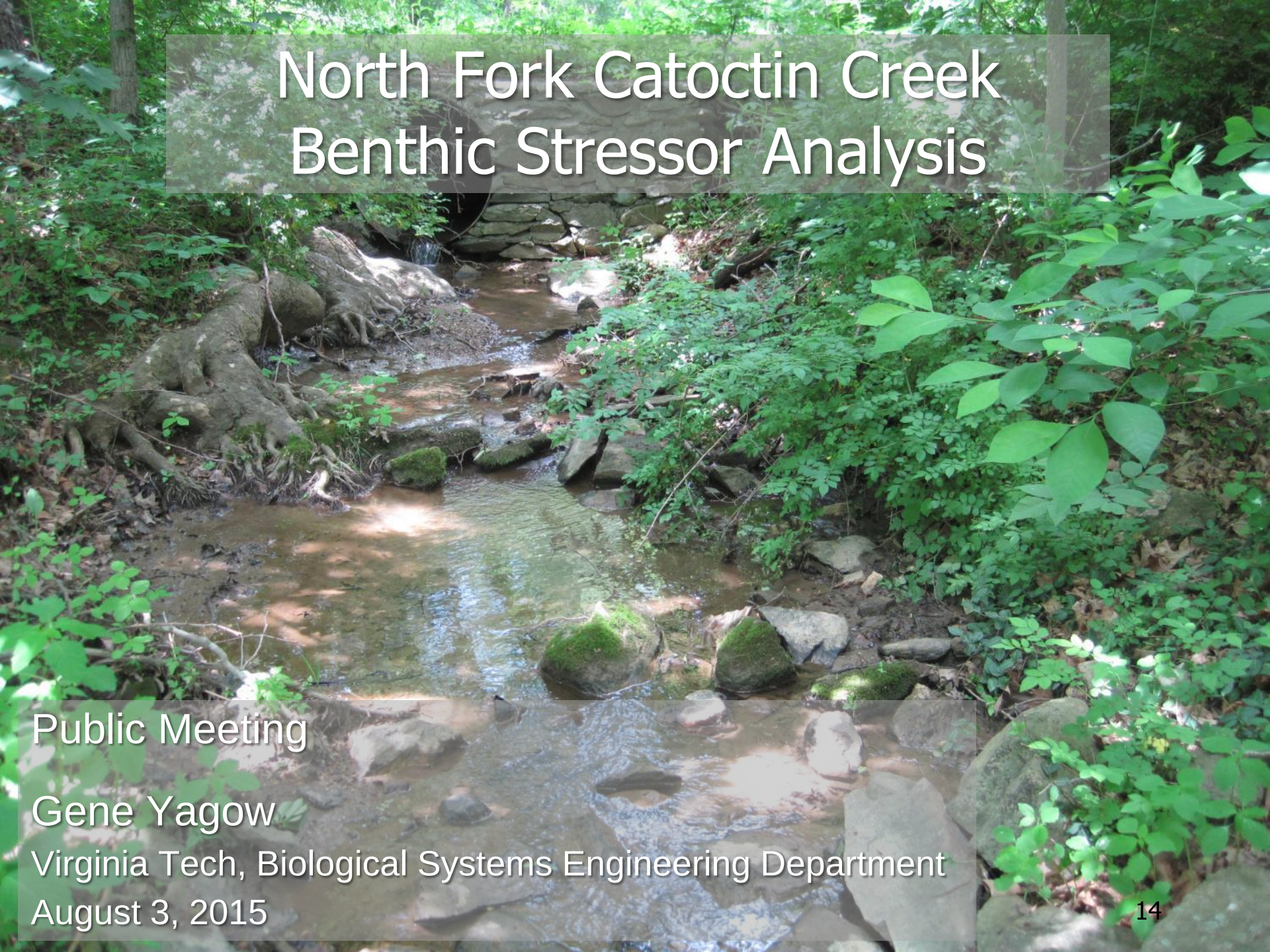
   Dissolved oxygen, nutrients, pH, sediment, temperature, toxics, etc.

2. Analyze the evidence for and against each pollutant:

   Biological, habitat, water quality, historic data, etc.

3. Categorize each of the causes as being one of the following:





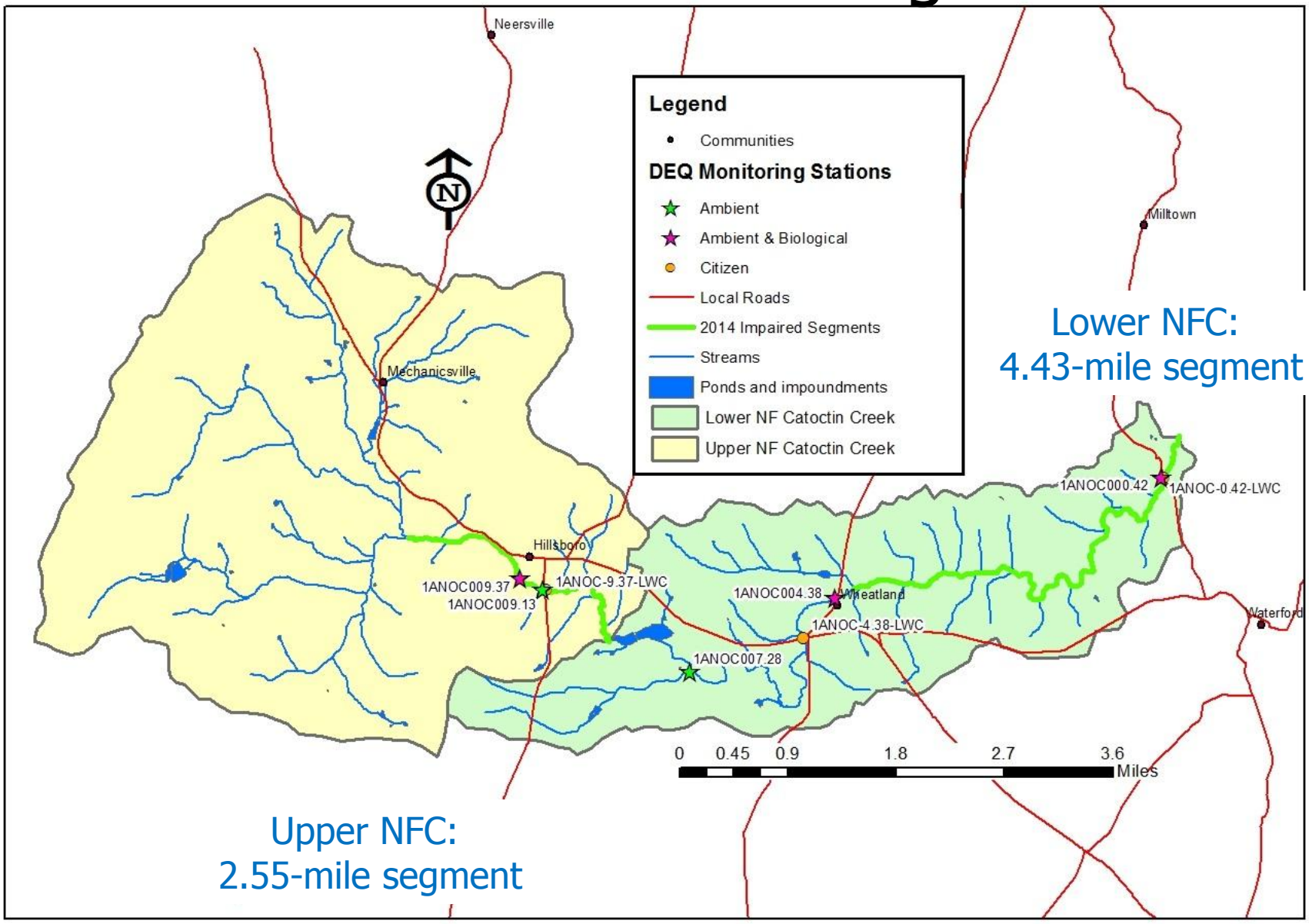
North Fork Catoctin Creek Benthic Stressor Analysis

Public Meeting

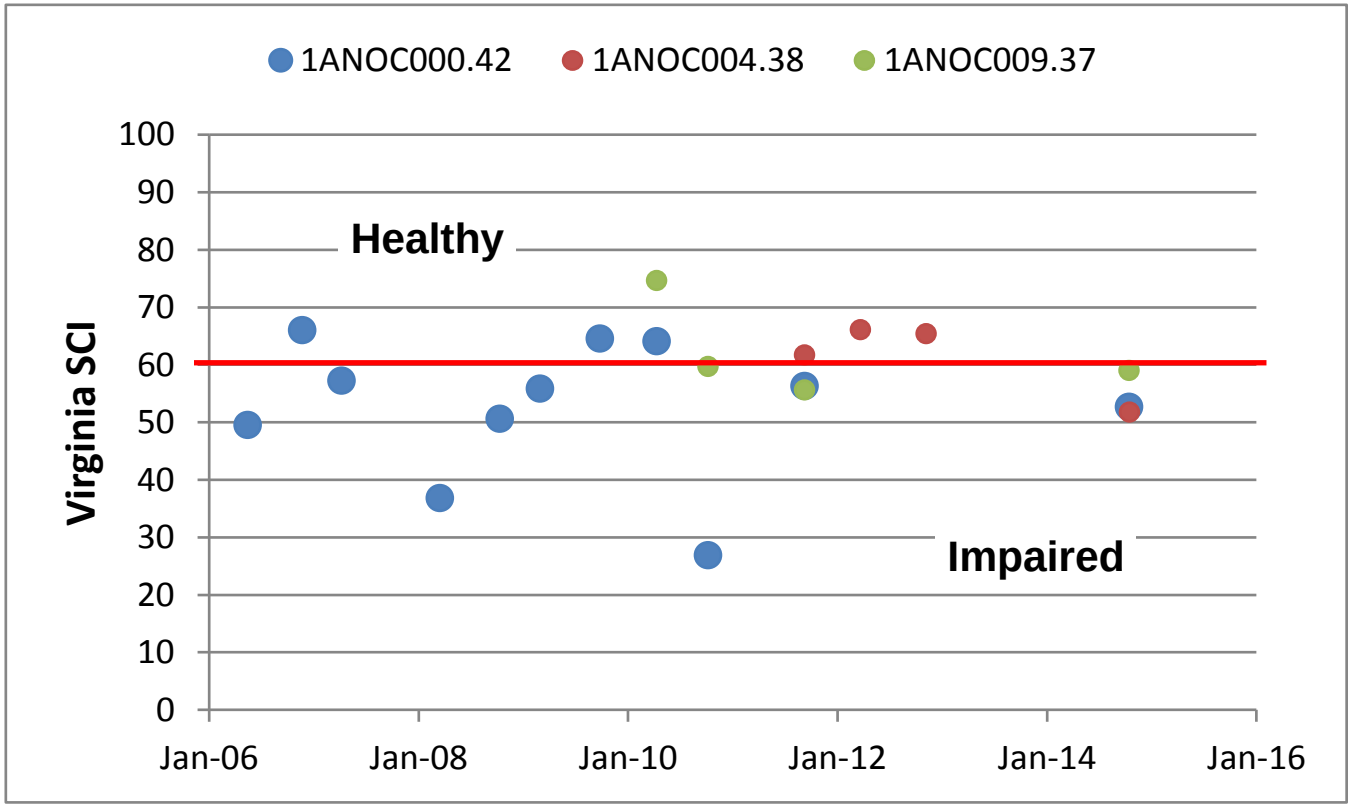
Gene Yagow
Virginia Tech, Biological Systems Engineering Department

August 3, 2015

NF Catoctin Creek Monitoring Stations



Basis for Impairment



VSCI = Virginia Stream Condition Index

Potential Pollutants

- ammonia,
- pH,
- temperature,
- metals,
- toxic organic compounds,
- nutrients (dissolved oxygen),
- organic matter,
- streambed sedimentation,
- ionic strength (sulfates, conductivity, total dissolved solids), and
- flow/hydrologic modification.

Potential Pollutant Sources

- Agriculture
- Construction
- Stormwater runoff
- Permitted discharges
- Livestock in the creek
- Septic systems
- Spills and illegal discharges

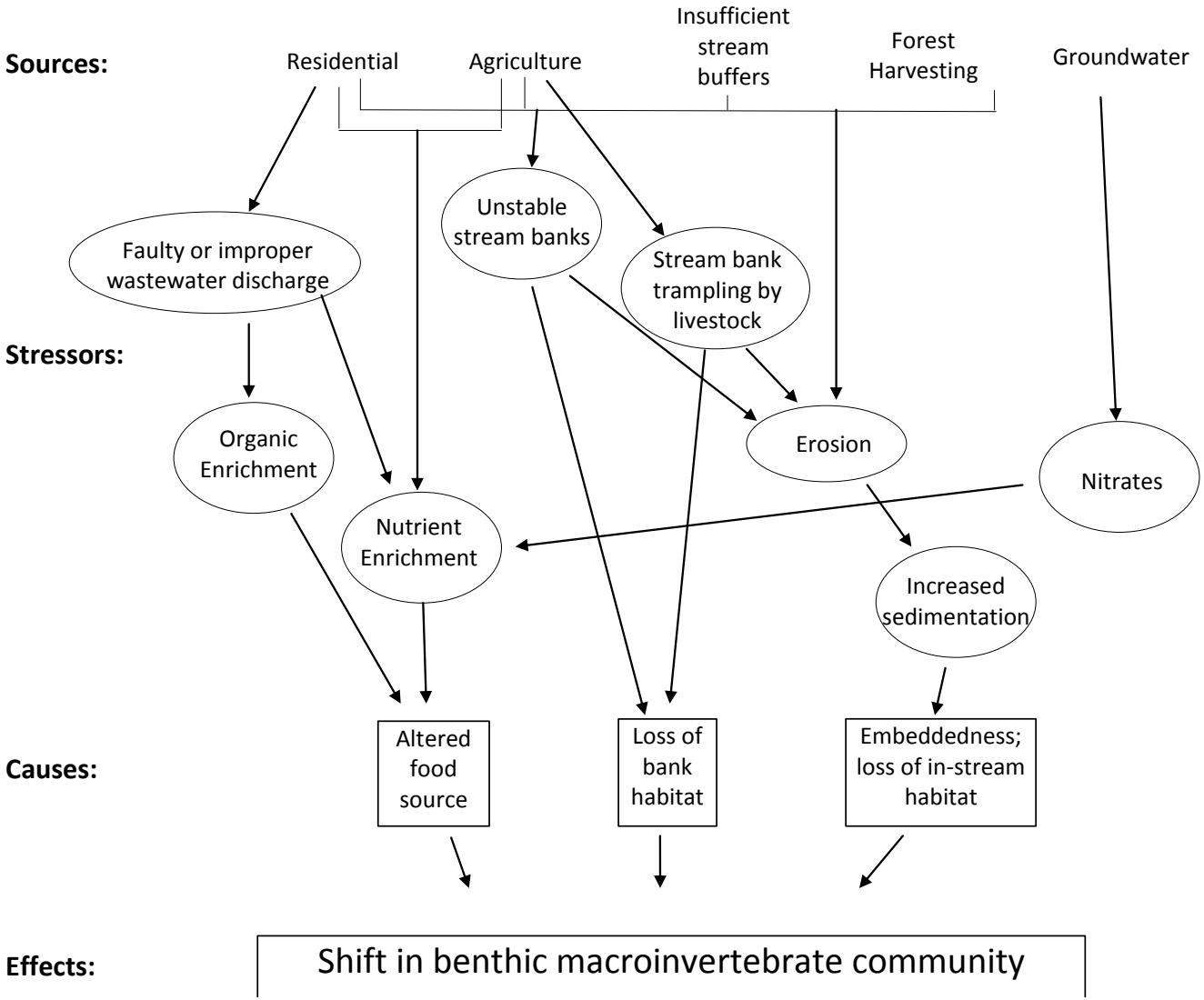
Stressor Analysis

- Benthic impairment does not specify pollutant(s)
- Review existing data
- Weight-of-evidence approach
- Identify “most probable” source(s)

Data Sources

- DEQ ambient and biological monitoring data, permits, PReP incidents, dissolved metals, and synoptic sampling
- Loudoun Watershed Watch monitoring data
- DCR dam inventory and BMP installation data
- Surface water withdrawal summaries
- Loudoun County WebLogis data, WRMP summaries, potential pollution sources, 2009 stream assessment, aerial archives
- USGS daily water flow data
- USDA-NASS cropland data layer
- Shenandoah Valley SWCD TMDL Implementation report
- USDA-NRCS 2000-2003 fish IBI and SVAP data
- MWCOG 2005-2006 stream assessment data
- Household drinking water analyses (2010 & 2013)

Interaction of Multiple Stressors

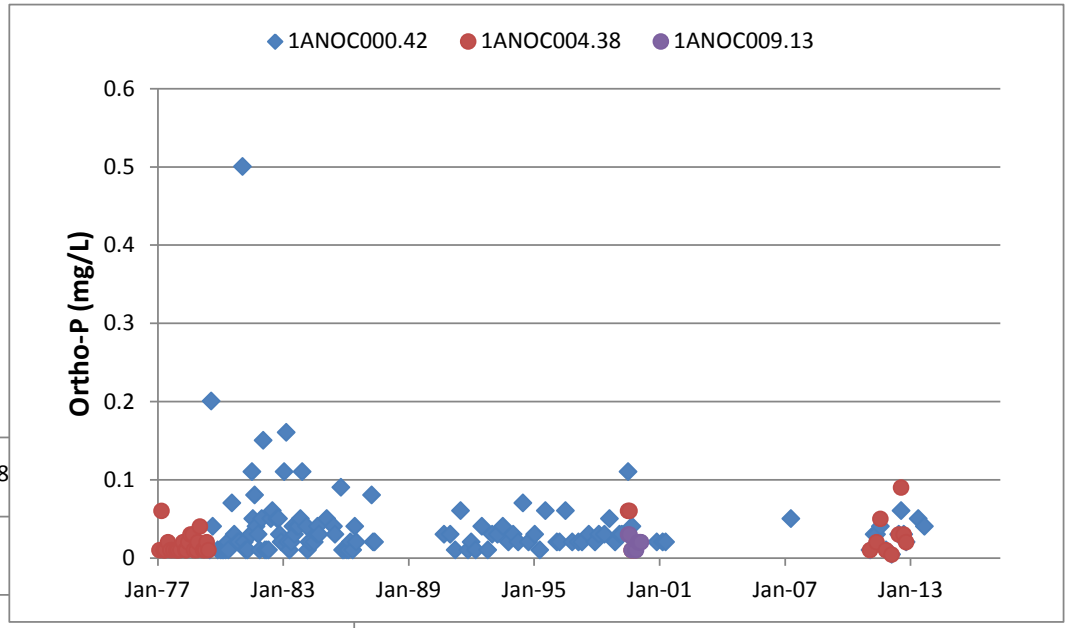


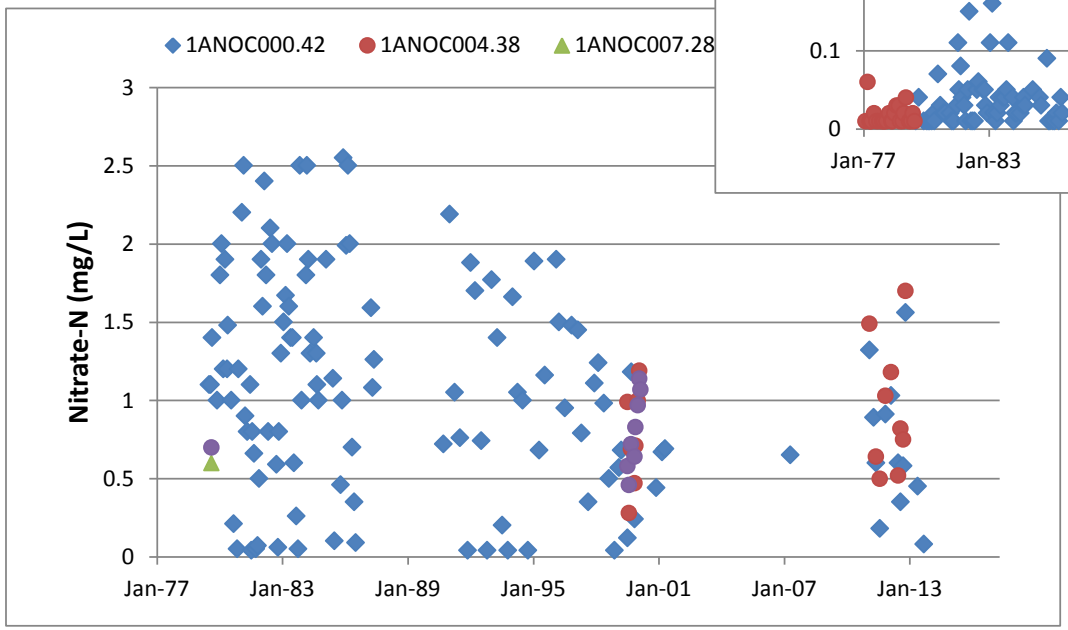
Eliminated Stressors

- Ammonia
- pH
- Temperature
- Dissolved Metals
- Toxic organic compounds

Possible Stressors

- Nutrients





DEQ ProbMon Screening Values

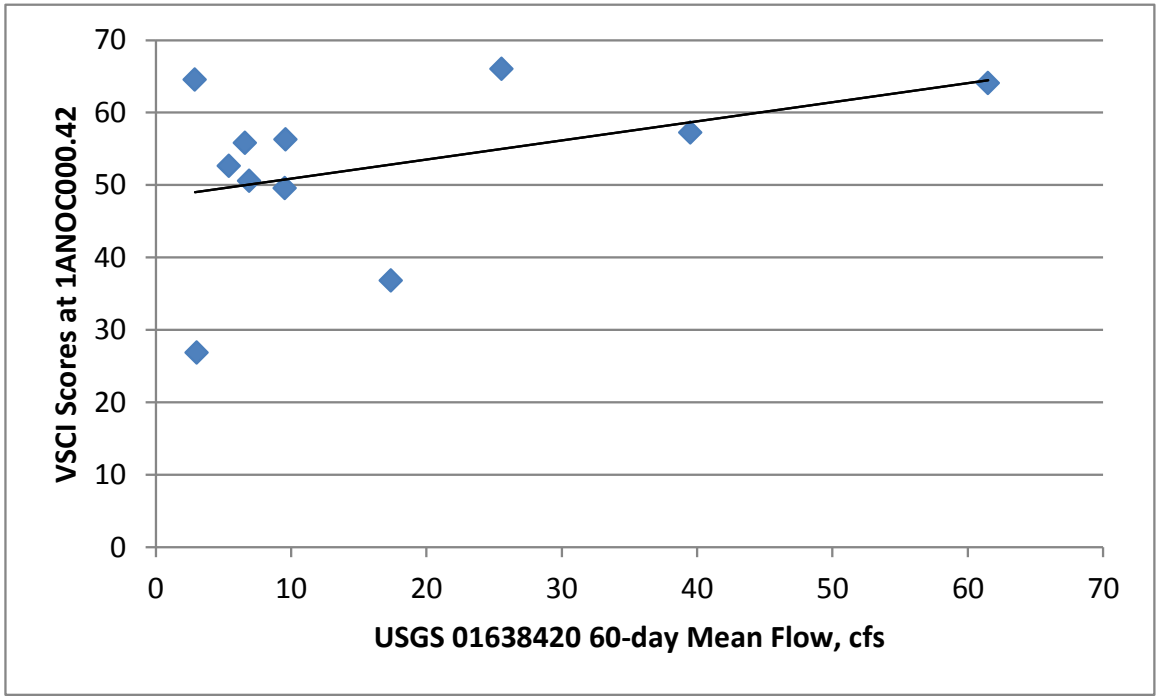
- Not water quality criteria
- Useful for interpreting data

DEQ Stressor Parameters	Alternate Name	Units	Suboptimal	Optimal	Reference
Total Nitrogen	Total Nitrogen	mg/L	>2	<1	VDEQ, 2006a
Total Phosphorus	Total Phosphorus	mg/L	>0.05	<0.02	VDEQ, 2006a
Habitat Degradation	Total Habitat Score	unitless	<120	>150	USEPA, 1999
Streambank Sedimentation	LRBS siltation Index	unitless	<-1.0	>-0.5	Kaufmann, 1999
Ionic strength	TDS	mg/L	>350	<100	VDEQ, 2006b
Metals Water Column	Metals Cumulative Criterion Unit (CCU)	unitless	>2	<1	Clements, 2000

		Total Nitrogen	Total Phosphorus	Total Habitat	LRBS Siltation Index
Upper NFC	pre-2006	Fair	Fair	Optimal	Optimal
	2006-2014	--	--		
Mid NFC	pre-2006	--	Suboptimal	Fair	Optimal
	2006-2014	Fair	Fair - Suboptimal		
Lower NFC	pre-2006	--	Suboptimal	Suboptimal	Fair
	2006-2014	Fair	Suboptimal		

Most Probable Stressors

- Hydrologic Modifications/Flow
  - Correspondence between VSCI scores and 60-day mean flow – lower NFC



Hydrologic Modifications (con't.)

- Correspondence between VSCI and "no-flow" periods – upper NFC and lower NFC

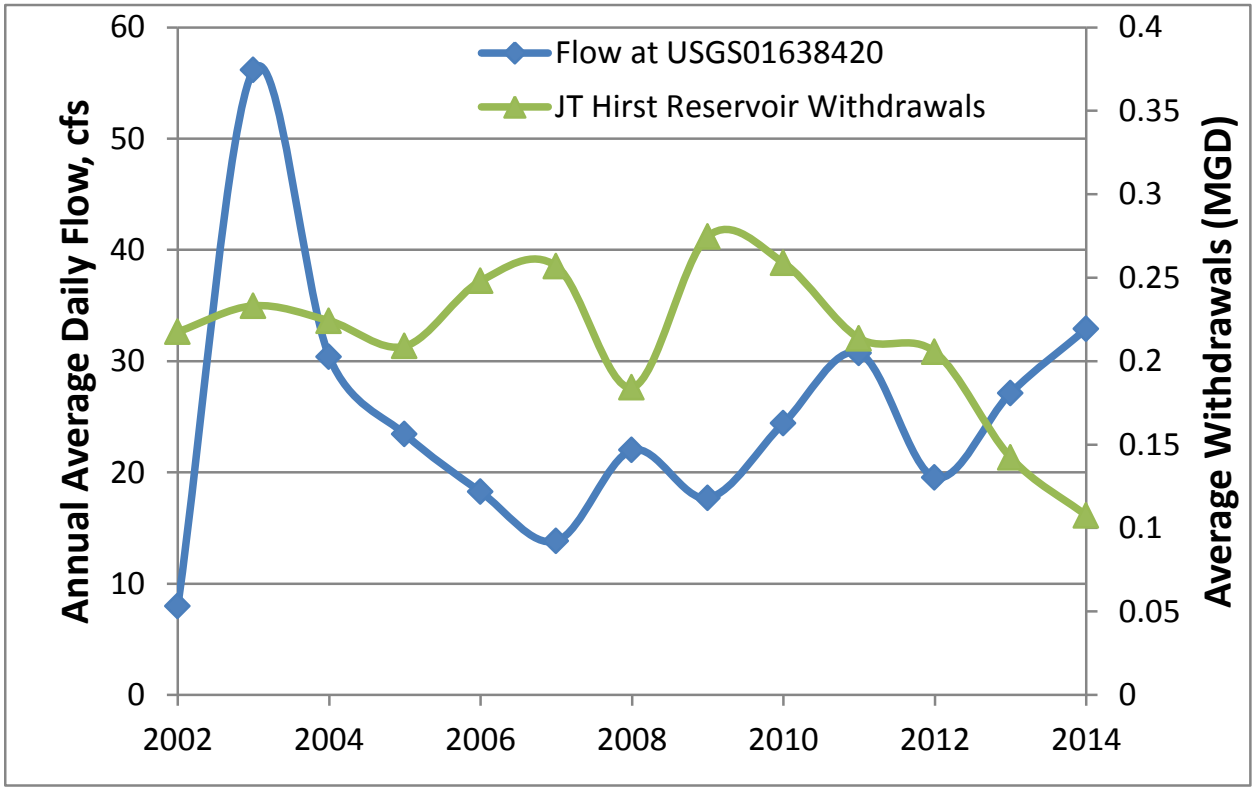
Year	No. Days with No Flow	Dry Months	VSCI Scores					
			1ANOC000.42		1ANOC004.38		1ANOC009.37	
			Spring	Fall	Spring	Fall	Spring	Fall
2001	0							
2002	**37**	Aug, Sept						
2003	0							
2004	0							
2005	0							
2006	0		49.5	66.0				
2007	**47**	Sept, Oct	57.2	NS				
2008	0		**36.8**	50.6				
2009	0		55.8	64.5				
2010	**26**	Sept	64.1	**26.9**			74.7	**59.7**
2011	0		NS	56.3		61.7	NS	55.6
2012	0		NS	NS	66.1	65.4	NS	NS
2013	0		NS	NS	NS	NS	NS	NS
2014	0		NS	52.6	NS	51.8	NS	59.0

NS = no sample taken, after the initiation of biological monitoring at each site.

Values are high-lighted in red for Fall and Spring samples that followed no-flow periods.

Hydrologic Modifications (con't.)

- Increasing annual flow with decreasing withdrawals since 2009 – lower NFC



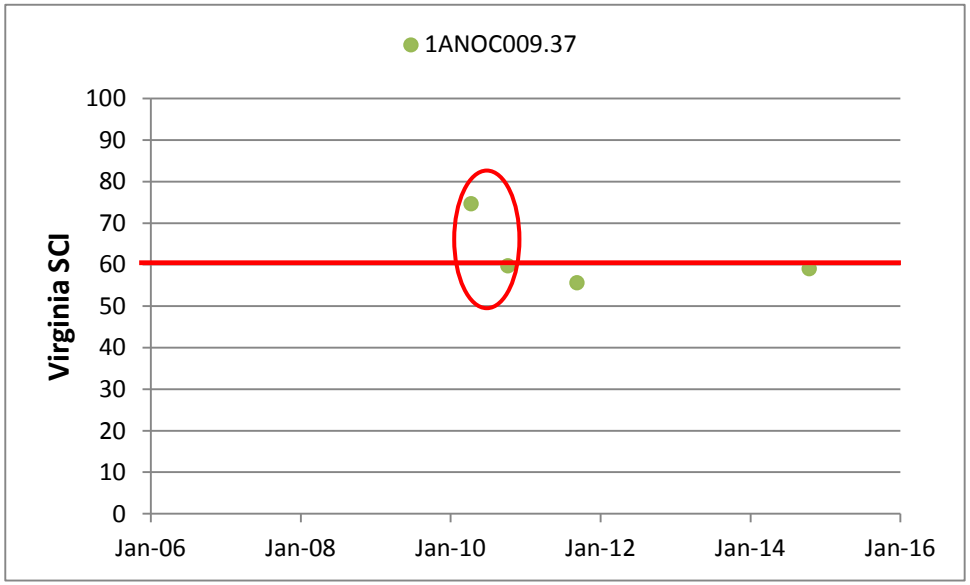
Most Probable Stressors (con't.)

- Sediment

Metric	Upper	Mid	Lower
Habitat "poor" or "marginal"			
embeddedness	0/4	1/4	1/11
bank stability	0/4	3/4	9/11
vegetative protection	0/4	0/4	9/11
riparian vegetative zone width	2/4	0/4	10/11
sediment deposition	0/4	2/4	10/11
LRBS Siltation Index metrics			
percent sand & fines	11%	19%	53%
embeddedness	44%	54%	76%
LRBS rating	optimal	optimal	fair
livestock in-stream	2	2	3

Summary

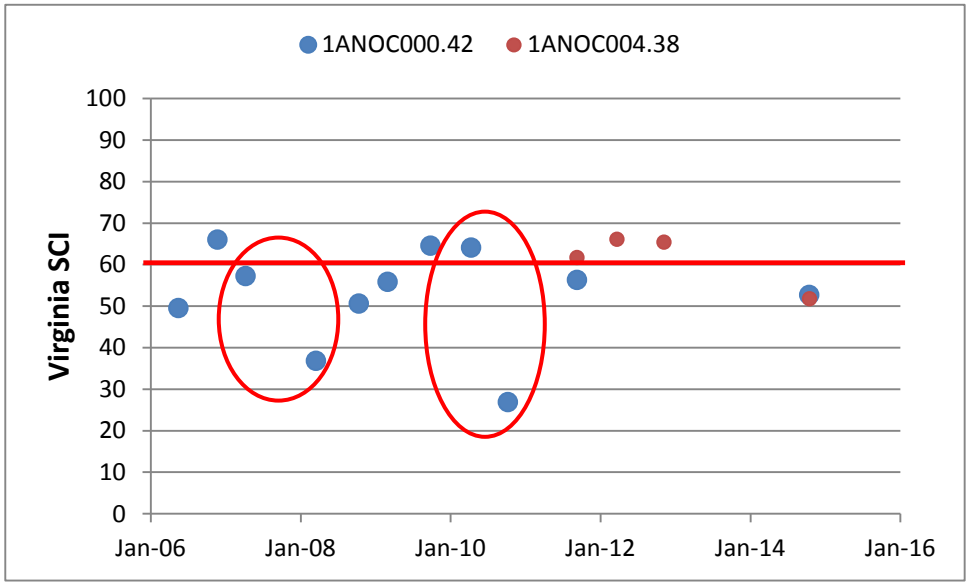
- Upper NF Catoctin Creek (VAN-A02R_NOC03A02)
  - Benthic impairments solely related to low-flow conditions.



  - Recommend reclassification as a Category 4C water.
  - No TMDL required – impairment is not caused by a pollutant.

Summary (con't.)

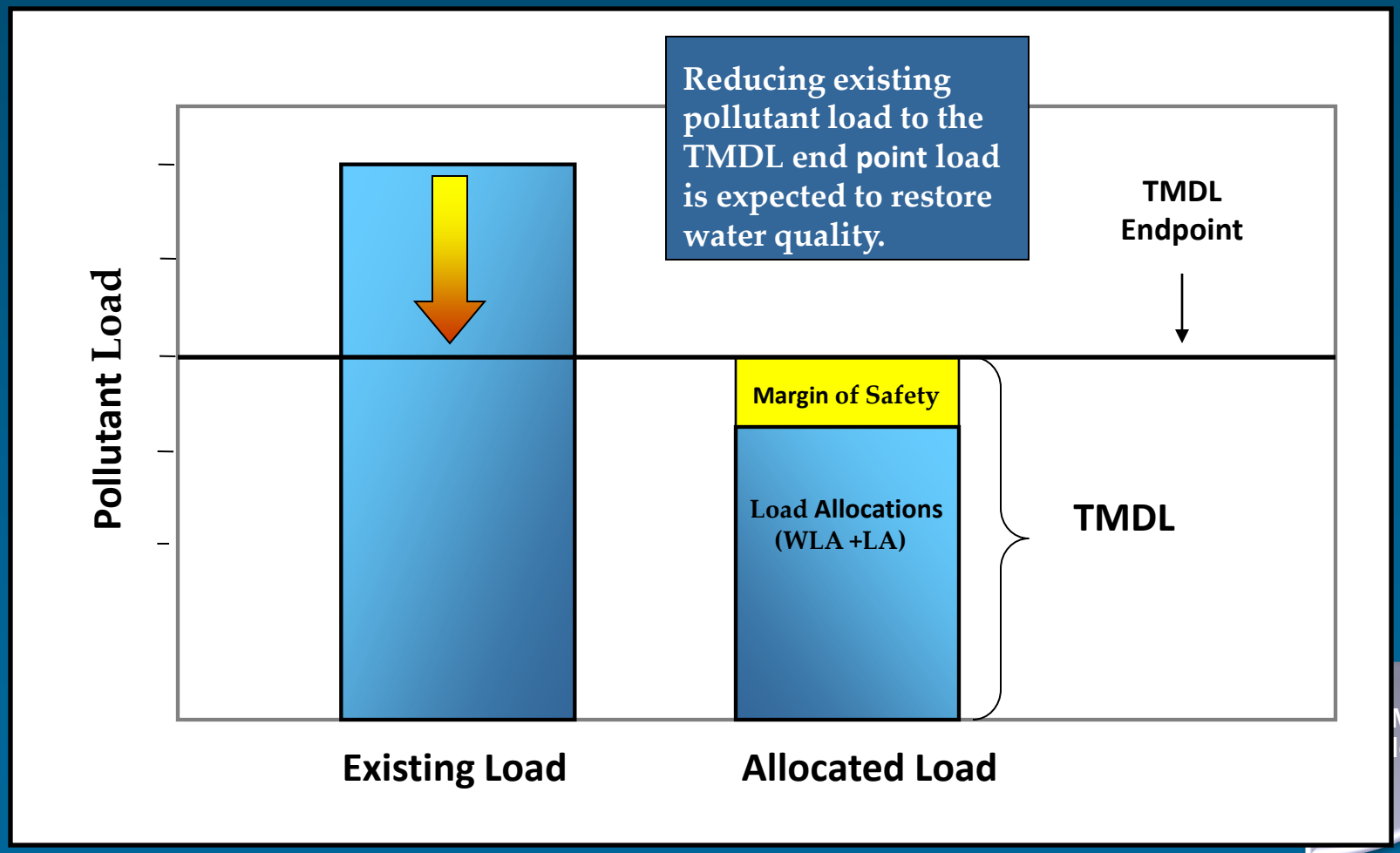
- Lower NF Catoctin Creek (VAN-A02R_NOC01A00)
  - Some VSCI scores affected by low-flow periods



  - But sediment is another "most probable stressor" during other flow conditions.
  - Recommendation: develop TMDL for sediment.

Stressor Analysis Conclusions

Address the lower segment benthic impairment by developing a sediment TMDL



Benthic TMDLs

Stressor Analysis

- Data gathering and watershed information
- Identification of most probable stressors

Target completion date – September 2015

TMDL

- Modeling and establishment of endpoints for pollutant stressors
- Determination of loads and reductions

Target completion date – Summer 2016

Implementation

- TMDL requirements implemented through permits for point source discharges
- Plans may be developed to address non-point sources
  - Collaborative process between stakeholders
  - Identification of best management practices and funding sources to address TMDL reductions

What next?

Comment period for materials presented tonight:

August 3, 2015 to September 2, 2015

Comments should be submitted in writing to:

Jennifer Carlson

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DEQ – Northern Regional Office

13901 Crown Court
Woodbridge, VA 22193

Questions? Comments?

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